MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2018/2019

TMA1401 – MATHEMATICS FOR INFORMATION SYSTEMS I

(All sections / Groups)

6 MARCH 2019
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTION TO STUDENT

1. This question paper consists of 4 printed pages (inclusive of the front page) with 4 questions only. Page 4 is the appendix for the logical equivalence laws.
2. Attempt **ALL FOUR** questions. The distribution of the marks for each question is given.
3. Please print all your answers in the Answer Booklet provided.
4. Show **ALL** of your working steps clearly.

QUESTION 1 **[TOTAL: 10 MARKS]**

a) Let the universal set U be the set of all integers, set $A = \{x \mid -1 \le x \le 6\}$ and set $B = \{x \in Z^{+} \mid 3 \text{ divides } x\}$.

i) List all the elements of A and B. [2 marks]

ii) Find $A - B$. [1 mark]

iii) Is $(A - B) \subset B$? Justify your answer. [1.5 marks]

b) Suppose $R = \{(1,1),(1,2),(2,1),(2,3),(3,1),(3,2),(3,3)\}$ and $S = \{(1,1),(1,3),(2,2),(2,3),(3,1),(3,2),(3,3)\}$ are relations on the set $C = \{1,2,3\}$.

i) Is R transitive? Justify your answer. [1.5 marks]

ii) Find $R \circ S$. [1 mark]

c) Consider the following function:

$f : \{x \in \mathrm{N} \mid x \le 4\} \rightarrow \{y \in \mathrm{Z}^{+} \mid y \text{ is even} \wedge y \le 12\};\ f(x) = 2x + 4$

i) Determine the domain, codomain and range of f. [1.5 marks]

ii) Is f onto? Justify your answer. [1.5 marks]

QUESTION 2 **[TOTAL: 10 MARKS]**

a) Consider two points, $A = (1,-3,3)$ and $B = (-4,-2,2)$.

i) Find the parametric equations and symmetric equations of the line that passes through the point $(-1,2,4)$ that is parallel to the line joining AB. [3.5 marks]

ii) From the symmetric equations obtained in (i), find the point that the line in (i) intersects the xy-plane. [1.5 marks]

b) Consider the following system of linear equations:

$$\begin{aligned} -3x - 2y + 4z &= 9 \\ 3y - 2z &= 5 \\ 4x - 3y + 2z &= 7 \end{aligned}$$

i) Express the system of linear equations in augmented matrix form. [1 mark]

ii) With the form obtained in (i), solve the system of linear equations using Gaussian elimination with back-substitution. [4 marks]

Continued ...

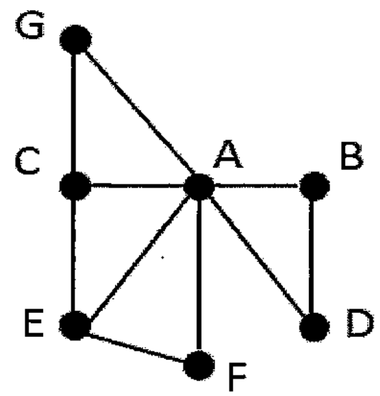
QUESTION 3 **[TOTAL: 10 MARKS]**

a) Use logical equivalence laws to show $\neg[p \vee (p \rightarrow \neg q)]$ is a contradiction. [5 marks]

b) Use mathematical induction to show that $4 + 8 + 12 + \ldots + 4n = 2n^2 + 2n$ for all positive integers n. [5 marks]

QUESTION 4 **[TOTAL: 10 MARKS]**

a) Given the following graph:



Use the **depth first search** algorithm to find a spanning tree for the above graph. Take vertex A as the root and apply alphabetical order if there is more than one choice in the path. Show clearly each step of how the algorithm is performed and present your answers in a table with three columns, the first column is the number of steps, the second column is the stack for the search algorithm and the third column is the edges of the resulting spanning tree. [7 marks]

b) A spyware is trying to break into a system by guessing its password. Determine the maximum number of times that it will need to try, if by rules, the password must consist of:

i) FOUR different upper case letters [1.5 marks]

ii) Any FOUR characters including letters and numbers (repetition is allowed) [1.5 marks]

Continued ...

Appendix

List of Logical Equivalence Laws

Conversion of Implication: $p \rightarrow q \Leftrightarrow \neg p \vee q$

Conversion of Equivalence: $p \leftrightarrow q \Leftrightarrow (p \rightarrow q) \wedge (q \rightarrow p)$

Double Negation: $\neg\neg p \Leftrightarrow p$

DeMorgan :	(i)	$\neg (p \wedge q) \Leftrightarrow (\neg p \vee \neg q)$		
	(ii)	$\neg (p \vee q) \Leftrightarrow (\neg p \wedge \neg q)$		
Domination :	(i)	$p \wedge F \Leftrightarrow F$	(ii)	$p \vee T \Leftrightarrow T$
Negation :	(i)	$p \wedge \neg p \Leftrightarrow F$	(ii)	$p \vee \neg p \Leftrightarrow T$
Identity :	(i)	$p \wedge T \Leftrightarrow p$	(ii)	$p \vee F \Leftrightarrow p$
Commutative :	(i)	$p \wedge q \Leftrightarrow q \wedge p$	(ii)	$p \vee q \Leftrightarrow q \vee p$
Idempotent :	(i)	$p \vee p \Leftrightarrow p$	(ii)	$p \wedge p \Leftrightarrow p$
Distributive :	(i)	$p \wedge (q \vee r) \Leftrightarrow (p \wedge q) \vee (p \wedge r)$		
	(ii)	$p \vee (q \wedge r) \Leftrightarrow (p \vee q) \wedge (p \vee r)$		
Associative :	(i)	$p \vee (q \vee r) \Leftrightarrow (p \vee q) \vee r \Leftrightarrow p \vee q \vee r$		
	(ii)	$p \wedge (q \wedge r) \Leftrightarrow (p \wedge q) \wedge r \Leftrightarrow p \wedge q \wedge r$		
Absorption :	(i)	$p \vee (p \wedge q) \Leftrightarrow p$		
	(ii)	$p \wedge (p \vee q) \Leftrightarrow p$		

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